



PRECIOUS JEWELS: AND DAMSELFLIES

DRAGONFLIES

Preserving the resources of the National Parks for the enjoyment of future generations is the fundamental purpose of the National Park Service. In the landscape of accelerated development and population growth in the mid-Atlantic region, National Parks and other protected areas contain the last remnants of habitats critical for the survival of many species. Inventories produce the baseline information that park managers need to effectively protect these resources. As we continue our inventories of natural resources in the parks of the National Capital Region, many species not previously recorded are revealed, and the value of our urban parks is even more apparent.

The story of how we came to learn about the impressive diversity and value of our dragonflies and damselflies (the odonates) is one of ecological connections and shared interest in preserving biodiversity and protecting human health. The National Capital Region manages important wetlands, which is habitat for the odonates. The National Capital Region also serves more than 40 million visitors annually, which accounts for 20% of the total National Park Service annual visitation (NPS 2001). West Nile Virus is established in the Washington, D.C. area and efforts are underway to monitor for the vectors and the disease throughout the National Capital Region.

How are dragonflies and West Nile Virus connected? The connection is ecological because West Nile Virus is a mosquito-borne virus. Both the mosquitoes that transmit West Nile Virus and the odonates share the same aquatic habitats. If there is a need in the future to

aggressively control mosquito populations, this could adversely affect other aquatic organisms. Dragonflies and damselflies play an important role in freshwater aquatic environments. The immature stages (nymphs) live totally under water, occupying all types of aquatic habitats, including both moving and still water, where they spend most of their early life feeding on various sorts of small aquatic organisms. When a nymph is fully grown, it crawls up out of the water, usually on a plant stem or rock, and undergoes its final molt. Once out of the last nymphal skin (exuvia) the adult expands to its full size and goes on to a life on its wings.

Odonates are excellent indicator species, which means that the odonate community composition of a given aquatic environment reflects the overall health of that system (Corbet 1999). Changes in aquatic systems are quickly reflected in changes in the odonate species



The lives of odonates are connected to water; the immature stages are aquatic and the adults are usually found near water. The wide variety of habitats along the Potomac River contribute to odonate diversity; these habitats include tidal marshes (top), slow flowing channels (middle), and streams with moderate flow (bottom).

composition, which are often at faster rates than can be monitored for most other plant or animal groups. Odonate species are currently at risk from a number of environmental threats, including habitat destruction and contamination.

Richard Orr (Versar, Inc., Columbia, Maryland) conducted a study of dragonfly and damselfly populations in multiple parks of the National Capital Region from 2002 to 2004. He designed the study to provide

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critical life history information for park managers so that future West Nile Virus vector control management practices could be developed or modified to reduce the risk to these species and their habitats from pesticide spraying and other park activities. The project had the added value of providing a comprehensive list of the dragonflies and damselflies found in our parks and an assessment of their conservation status and needs, allowing parks to better address rare species issues.

The meticulous and intensive sampling conducted by Mr. Orr included Rock Creek Park, Harpers Ferry National Historical Park (West Virginia, Maryland, and Virginia sections), the Potomac Gorge (Theodore Roosevelt Island to Bealls Island; including property managed by George Washington Memorial Parkway and Chesapeake and Ohio (C&O) Canal National Historical Park, District of Columbia, Maryland, and Virginia), and the C&O Canal National Historical Park (from Bealls Island to Antietam Creek, Maryland; including the Potomac River). The investigator sampled all permanent and temporary wetland habitats including the Potomac River, the C&O Canal, marshes, seeps, ponds, and tributaries within the boundary of each park.

Because many odonate species are rare and their aquatic habitats are difficult to access and sample, species data come from the identification of adults observed using binoculars or caught with nets, and collections of exuviae (the cast exoskeleton remains left by emerging adults). Since exuviae are ephemeral (time sensitive), their presence provides important life history information such as emergence times and distributions of some of the rare adult species. Mr. Orr's final analysis also included data from a detailed study of the dragonflies and damselflies of the Potomac River and C&O Canal that he conducted from 1994 through 1996.

A very important component of the survey effort was the participation of 23 volunteers working through Partners-in-Parks who

Science Informing Management

With the introduction of the mosquito-borne West Nile Virus to the Washington, D.C. area in 2000, aquatic ecosystem management in the National Capital Region also addresses human health concerns. The descriptions, life histories, and locations of rare dragonflies and damselflies are now known for each of the parks that Mr. Orr studied. Park managers are able to use the information to minimize adverse effects on odonate populations. Care will be taken to prevent significant population-level impacts on rare odonate species.

For example, Mr. Orr's study reveals that the larval habitats of the two mosquito species (*Culex quinquefasciatus* and *C. pipiens*) found in the mid-Atlantic region and pose the most risk to human health for the spread of the virus differ from those of the rare odonate species found

in the parks (CDC 2003). Mosquito larvae prefer dark to semi-dark, highly organic (e.g., wetlands and sewage treatment plants effluent), and still-water habitats. However, the larval habitats for the odonates of special concern are rivers, streams, or clean-fresh water seeps. Therefore, applying larvicides to the specific habitats where mosquito larvae occur should not threaten odonates of special concern. On the other hand, the toxicological effects of mosquito-targeted sprays on adult dragonflies are not fully understood. As adults, mosquitoes feed actively during the early morning, evening, and night hours. The majority of dragonflies and damselflies found in the National Capital Region are diurnal. Therefore, proper application of treatments should occur when odonate species are not active.

provided 552 hours of additional field work. These volunteers searched for casts in 2003 and 2004 and collected nearly 2,000 dragonfly exuviae that they provided to Mr. Orr for identification and counting.

Impressive diversity

The results of this study revealed an impressive wealth of odonate species from a biodiversity standpoint. Equally impressive is the high numbers of dragonfly and damselfly species that have been identified as having conservation importance on State Heritage lists of threatened or endangered species.

In total, Mr. Orr found 101 species of dragonflies and damselflies utilize habitats within the surveyed units of the National Capital Region. Mr. Orr and volunteers collected over 100,000 individual data points. Forty-five of the species have conservation importance due to rarity

in at least one or more of the political entities of the District of Columbia, Maryland, Virginia, and West Virginia and are represented within the surveyed area.

The discovery of the Potomac Snaketail (a new species of *Ophiogomphus*) and the Tiger Spiketail (*Cordulegaster erronea*) are worth mentioning because of their conservation stature. The Potomac Snaketail is a previously undescribed species known from a single male collected within the C&O Canal National Historical Park. Recently emerged, the male specimen matches the description of the rare Wisconsin Snaketail, *Ophiogomphus susbehcha*. The Wisconsin Snaketail is considered one of the rarest dragonflies in the world and is exclusively found along the St. Croix River in Minnesota and Wisconsin (Vogt and Smith 1993). To correctly identify this unknown species, Mr. Orr compared the specimen with four specimens preserved in the national collection at the Department of Entomology, Smithsonian Institution. Differences in many structural features suggest that it is a new species of *Ophiogomphus*. This is a very exciting finding and the search for additional specimens is currently underway.



Field Guide to Dragonflies and Damselflies

Over 100 species of dragonflies and damselflies (odonates) have been located within the National Capital Region. Forty-five species are of conservation concern and importance. Mr. Richard Orr included 15 common odonate species in a field guide to assist park managers and interested visitors in the identification of the dragonflies and damselflies of Rock Creek Park, Chesapeake and Ohio Canal National Historical Park, George Washington Memorial Parkway, and Harpers Ferry National Historical Park.

Dragonflies and damselflies are large insects with well-developed eyes. Like birds, odonates use distinctive color patterns to identify individuals within their own species. Males, females, and young adults of the same species may vary in color. Mature males are usually the most brightly colored and most likely to be seen since they commonly defend territories or wait in the open for the more secretive females. Therefore, the guide focuses primarily on the identification of mature males of the most commonly seen species.



Mr. Orr (Versar, Inc.) documented more than 100 species of odonates in National Capital Region parks. Almost half are species of conservation concern and importance.

The collection and identification of the Tiger Spiketail at Rock Creek Park is also noteworthy. Historical records indicate that the species was first found within the District of Columbia in 1922, but it was not recorded as present in the Park again until 2001. Listed as rare by the Maryland Department of Natural Resources, Natural Heritage Program, the Tiger Spiketail requires seeps and small permanent clean-water rivulets, which are very fragile ecosystems throughout the Park. Mr. Orr saw only a few adult males during the 2002 and 2004 field seasons of this study. Therefore, the Park's Tiger Spiketail population is considered small and threatened. Further monitoring is needed to determine the likelihood of the species continued existence within Rock Creek Park.

These discoveries attest to the uniqueness and importance of the Potomac River as a biodiversity resource. At present, the

Potomac River corridor is highly regarded for its diversity of plant species. With these new invertebrate records, it should be clear that the unique biological value of the National Park Service sections of the Potomac River corridor and its tributaries is extraordinary. The high dragonfly diversity found in the study areas confirms the importance of the corridor for invertebrate conservation.

Urban development within the surrounding areas of the National Capital Region have caused changes to the Potomac River, its tributaries, and associated wetlands that contribute to the loss of dragonfly species. Mr. Orr found only small amounts of Spiketail and Gray Petaltail dragonflies, which is a change from the past when scientists found considerable numbers of these species in the study area. The Gray Petaltail was last recorded in the District

of Columbia in 1898, and it currently exists in small isolated areas of the Potomac Gorge (NPS and TNC 2001). Likewise, the Spiketail has been reduced to isolated populations that are rarely observed.

Effective management of the aquatic ecosystems of the National Capital Region requires a wide knowledge base from multiple ecological disciplines. The newly gained knowledge of our dragonfly and damselfly populations increases our ability to better protect park resources. Our small urban parks house more than 100 different kinds of dragonflies and damselflies and almost half of them are of known conservation importance.

Targeted monitoring efforts and consideration of temporal and spatial patterns of biocide and insecticide applications must be considered when spraying is used to manage mosquito populations (CDC 2003). However, the story is not that simple. Although odonates are good indicator

species for ecosystem health, their response to biocide and insecticide application should not be indicative of all non-target insects. Millions of stoneflies, caddisflies, and midges emerge from the Potomac and Shenandoah Rivers yearly. Some are likely more vulnerable to control methods than dragonflies and damselflies. Additionally, adult midges (chironomids) found throughout the National Capital Region are a major component of the food web in the Potomac River. Since odonates are closely related to mosquitoes in morphology and behavior, they are likely as vulnerable to control treatments as are the mosquito vectors for West Nile Virus (*Culex* species) (Orr 2005.)

References

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Integrated Pest Management The National Park Service implements a nationwide Integrated Pest Management Program to reduce risks to the public, park resources, and the environment from pests and pest-related management strategies. Integrated Pest Management is a decision-making process that coordinates the knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage. Integrated Pest Management uses cost-effective means that pose the least possible risk to people, resources, and the environment. The National Capital Region Integrated Pest Management Program provides coordination and technical assistance to the Region's parks. Integrated Pest Management ensures that the management of identified pests is carried out according to National Park Service policy in an effective and responsible manner that alleviates pest damage and protects resources.

